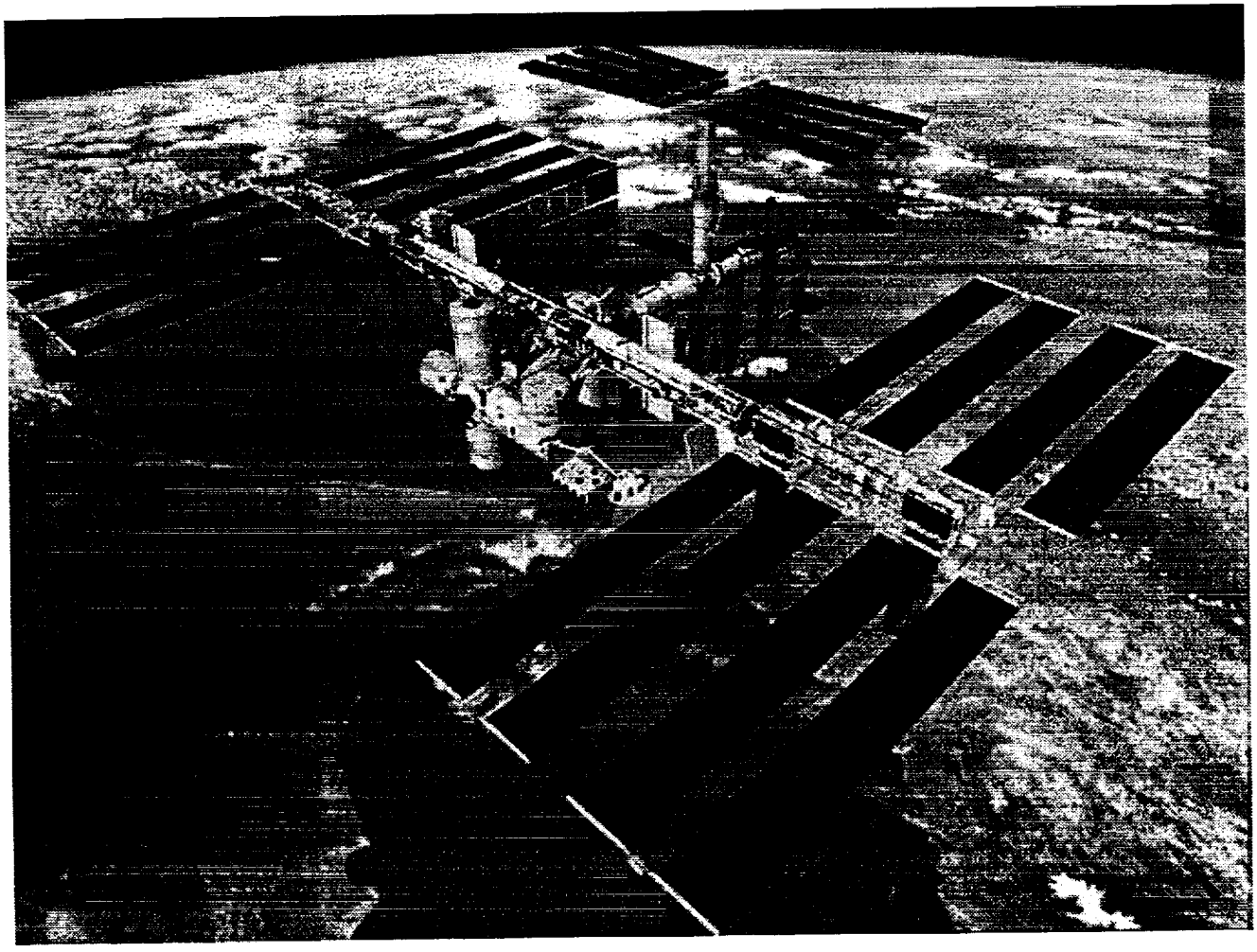
Commercial Development Plan for the International Space Station

16 November 1998



Commercial Development Plan
for the
International Space Station

Objective

- **Long Term**: To establish the foundation for a marketplace and stimulate a national economy for space products and services in low-Earth orbit, where both demand and supply are dominated by the private sector.

- **Short Term:** To begin the transition to private investment and offset a share of the public cost for operating the space shuttle fleet and space station through commercial enterprise in open markets.

Strategy

- In partnership with the private sector, initiate a set of pathfinder business opportunities which can achieve profitable operations over the long run without public subsidies. Employ these businesses to break down market barriers in the near term and open the path for economic expansion.

- Initialize the process through the internal NASA study of pathfinder candidates, as a point-of-departure, with emphasis on pushing the envelope in terms of both public and private sector policies, procedures and cultural predispositions [*study results provided in attachment 1*].

Tactics

1. ***Release Baseline Pathfinder Study with NASA Assessment of Goods and Services with Commercial Potential.***

    - Identify nine pilot business areas for private sector validation [*completed*].

    - Initiate business development in partnership with industry.

2. ***Commission an Independent Market Assessment to Initiate the Most Effective Pathfinders (Horizon: 6 Months)***

    - Task a nationally prominent business school with recognized high technology acumen, through a new cooperative agreement, to evaluate the prospect of the space station becoming a fee-for-service commercial technology development testbed.

    - Task SpaceVest, through existing cooperative agreement, to evaluate the private investment potential in emerging markets for space products and services which could be enabled through access to space shuttle, shuttle replacements and space station accommodations.

    - Task the United Space Alliance, through existing contract, to evaluate the prospect of space shuttles and space station as platforms for commercially provided products and services.

    - Task the Boeing Aerospace Corporation, through existing contract, to evaluate the prospect of the space station as a customer for commercially provided growth elements, distributed systems, and utility services.

    - Task the Commercial Space Centers, through existing cooperative agreements, to query their existing 135 industrial affiliates and evaluate the prospect of the space station becoming a fee-for-service product development laboratory or production center.

- Task the KPMG Peat Marwick Space and High Technology Practice, through existing contract, to convene a panel composed of representatives from each of the previously identified areas, and others as needed, to review the range of market assessments and to synthesize a report on: (a) the market potential; (b) perceived barriers to market entry, and; (c) the most effective pathfinder enterprises.

3. ***Characterize Barriers to Market Entry and Identify Corrective Actions (Horizon: 6 Months)***

Access to Space

- Direct a cross-program team to audit current practices for assigning space shuttle middeck accommodations and establish a minimum set-aside for flight opportunities on every mission [*underway*].

- Appoint a dedicated Senior Assistant for Access to Space, charged to continuously scan for, and secure, alternative flight opportunities on both reusable and expendable launch vehicles [*underway*].

- Benchmark the NASA cost to sortie one dedicated space shuttle mission per year, *Commerce Lab*, until the space station achieves full payload readiness. Identify as an augmentation in the FY 2001 NASA submit to the Office of Management and Budget.

Administrative Process

- Establish a clearing house function at NASA headquarters for the logging and dispositioning of commercial proposals. Implement through an agency-wide Organizational Work Instruction in compliance with ISO-9001 [*draft provided in attachment 2*].

Policy

- Acquire an experienced professional economist to update the 1985 Congressional Budget Office report on "Pricing Options for the Space Shuttles" and the 1994 National Academy of Public Administration report on "A Review of Space Shuttle Costs, Reductions Goals and Procedures". Benchmark historic marginal and average costs of space shuttle flights, and project costs for space station accommodations.

- Task the KPMG Peat Marwick Space and High Technology Practice to evaluate the effects of transitioning from a cost-based to value-based pricing policy with provisions for government cost offsets, and define objective methods for establishing value.

- Task the NASA Office of Policy and Plans and Office of Public Affairs to: (1) acquire the services of a recognized firm in the practice of name brand management to evaluate the value of space program associations in advertising and customer relations, and; (2) initiate a review of NASA practices related to commercial enterprises involving public service sponsorships, expressed or implied endorsements, or other situations which affect public perception of the nation's space program.

- Implement the pathfinder strategy as a forcing function to advance policies which will enable the commercial development of space shuttle and space station.

Intellectual Property

- Task the NASA Office of General Counsel to complete a reference guide discussing the statutory, regulatory and programmatic strictures on the deployment, utilization and ownership of intellectual property within the space station program.

- Building on General Accounting Office audit #707379 of technology control plans for the space station, task the NASA Office of General Counsel to review agency policy related to the handling and treatment of proprietary data. If necessary, issue a NASA Policy Directive to correct any deficiencies.

4. ***Establish a Non-Government Organization for Space Station Utilization Development and Management (Horizon: 1+ Year)***

   - Develop a reference model to communicate vision, goals, purposes and working principles for a non-government organization (NGO) to manage US utilization of the space station and to reduce cost/schedule impediments at the user-operator interface [*provided in attachment 3*].

   - Conduct a comprehensive vetting of stakeholders in the government, academic and industrial sectors, with the objective of elucidating advantages and disadvantages associated with for-profit, non-profit, and hybrid consortium approaches implemented under contractual or cooperative agreements.

   - Develop an organizational and telecommunications architecture that will be most effective for evolution to an international scope of operations consistent with the national objectives and existing infrastructure of all partners in the space station program.

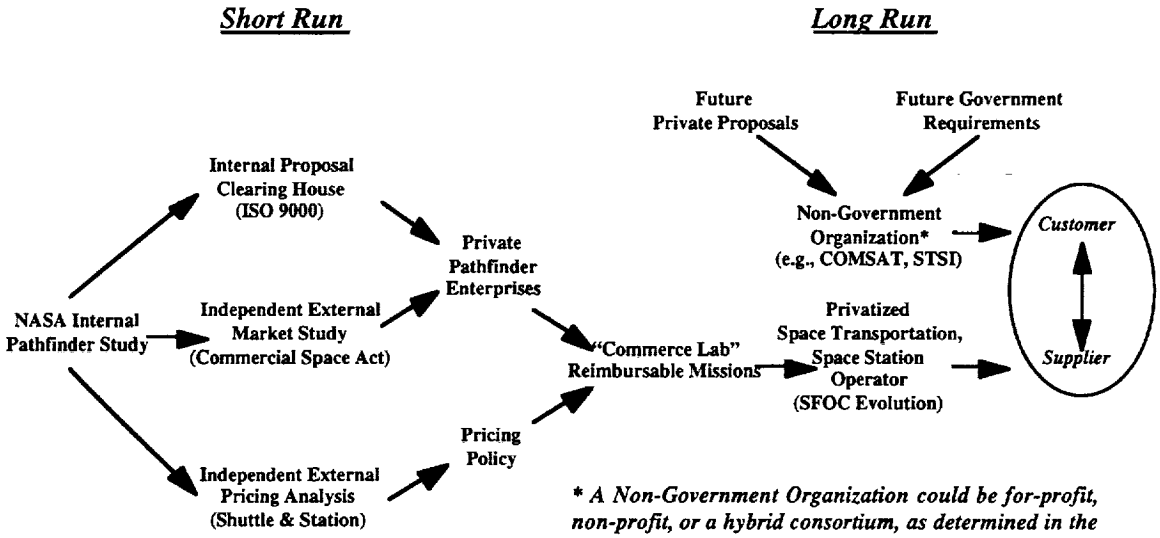
   - Issue a Request for Proposals and select a NGO in parallel with deployment of the US Laboratory in calendar year 2000.

This plan we have set forth, in concert with the 1998 Commercial Space Act, represents an unprecedented initiative to stimulate business growth in the space sector. With the ongoing support of Congress and the Executive Branch, we look forward with great excitement to the opening of the 21st century and the role of NASA in continuing to push the frontiers of science, technology and economic development.

Joseph H. Rothenberg
Associate Administrator, Space Flight

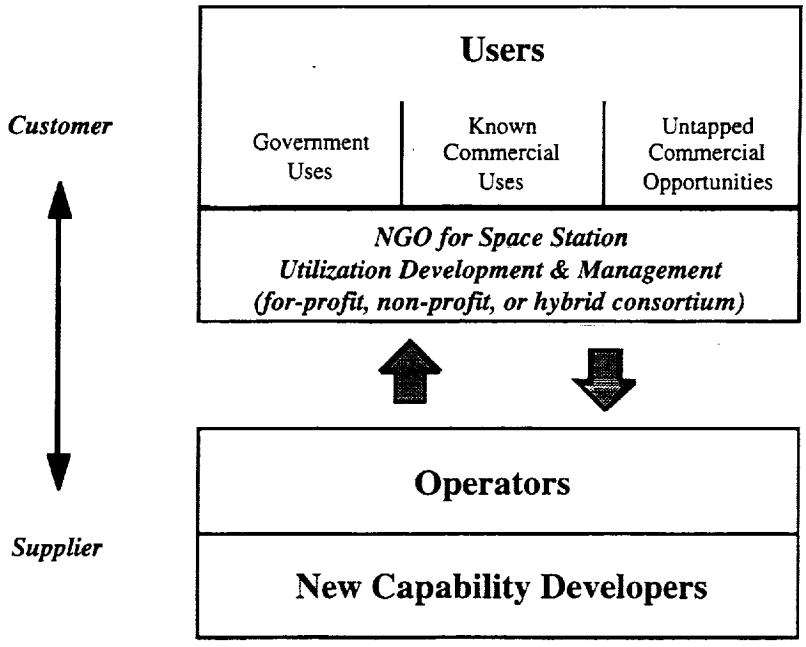
Arnauld E. Nicogossian
Associate Administrator, Life and
Microgravity Sciences and Applications

Restructuring the Space Economy

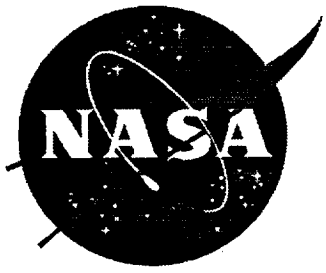


** A Non-Government Organization could be for-profit, non-profit, or a hybrid consortium, as determined in the course of evaluating pros and cons during the stakeholder vetting period.*

Establishing the Customer - Supplier Relationship



Attachment 1



INTERNAL STUDY

POTENTIAL PATHFINDER AREAS FOR COMMERCIAL DEVELOPMENT OF THE INTERNATIONAL SPACE STATION

Discussion Draft

October 1998

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Introduction

An internal study was undertaken to identify pathfinder business enterprises with the potential to illuminate the commercial development of the International Space Station (ISS) and break down any perceived barriers to such development. The process used to identify opportunities for commercialization, as well as potential pathfinders to evaluate these opportunities is shown in Figure 1 and described in this report.The study concentrated on delineating the scope of potential commercial opportunities associated with the ISS, as well as evaluating, from the NASA perspective, several pathfinder areas of potential interest to the private sector. The NASA approach, evaluation criteria, and results are provided in the following study report. As the plan for commercial development proceeds, it is anticipated that new business concepts will emerge and move to the forefront as private industry becomes involved. These concepts may be related to the pathfinders identified in this study, or they may represent entirely new and innovative space products or services. In either case, NASA intends to proceed with the most effective set, as determined by the new Government-industry partnership.

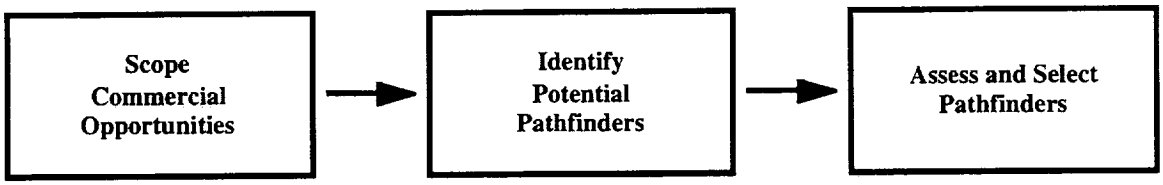


Figure 1: Process Description

II. International Space Station Commercial Opportunities

A. Scope of Commercial Opportunity

The ISS has three broad categories of commercial opportunity: (1) users; (2) operations, and; (3) new capability development (Figure 2). With each of these areas, NASA is using its position as both a customer and a service provider to stimulate new commercial space businesses. As the user base broadens, it is expected that NASA will become just one of the customers for commercial operations and new capabilities.

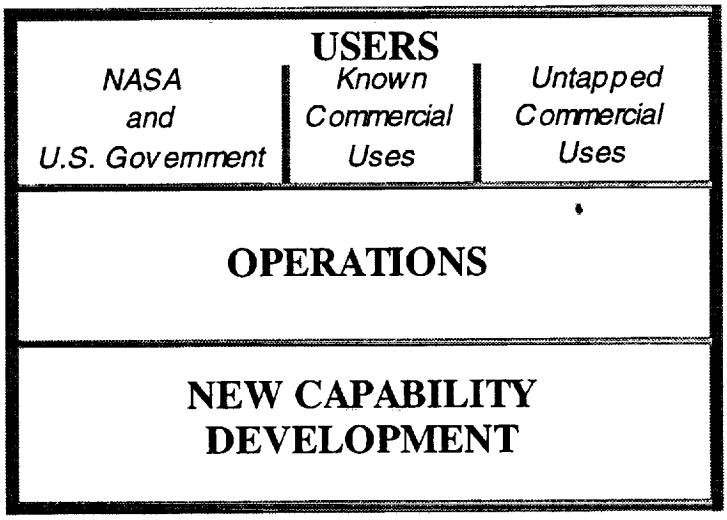


Figure 2: Scope of Commercial Opportunities

Users

NASA provides resources geared toward the unique capabilities and vantage point of the Station. The ISS will be an orbiting laboratory that will provide an unprecedented facility for long-term scientific research, technology development, and the achievement of commercial goals in the environment of space. To this end, the ISS has a variety of laboratory facilities available. These accommodations and services range from laboratory racks in pressurized modules, with full utility and crew services, to externally mounted attached payload sites that are exposed to the near vacuum of space. There are also viewing windows for observation.

The spectrum of ISS uses will broaden as the program evolves. For example, there are currently two proprietary users, which represent non-aerospace companies, with interests in using the ISS as a product development platform. In these cases the companies are pursuing ventures that are unprecedented in terms of willingness to invest private resources, as well as the diversity of their envisioned product lines.

As shown in Figure 3, there will be many new and previously untapped opportunities for using this unique facility once the ISS is deployed on orbit. To ensure that there will be adequate opportunities available for commercial uses, NASA has already committed to set aside at least 30 percent of the ISS's payload capacity for commercial development.

Operations

Private industry will provide the services necessary to maintain and continually improve ISS capabilities. Operating a space-based laboratory is different and far more complex than similar activities on Earth, but these are not insurmountable barriers for major U.S. service providers to overcome if they are to take their Earth-based services to space. The services needed for a research platform in low-Earth orbit are, in many cases, the same as are required anywhere on Earth or needed by the many satellites orbiting Earth. In the case of the Space Shuttle and the ISS-*Mir* programs, logistics support for both operations and the research community are already commercially provided.

The growing base of users will shape the future operational needs of the ISS. Commercial sources will provide and evolve these operational capabilities. NASA will become one of a number of paying customers for these augmented services. Candidates for ISS cover a wide range of opportunities, as encompassed in Figure 3.

New Capability Development

The commercial sector can provide capital improvements to the ISS based on the demand of both public and private customers. Such new capability development can be either enhancements to existing capabilities—for example, increasing the available power to the ISS users with commercially supplied power—or it can be a new capability—for example, a commercially provided module. Because of the large investment cost, this area represents the highest commitment of private funds. As with operations, new capability development will be market-driven by the profitability of the ISS uses and the increased demand. NASA, as one of many users, will benefit from these new and improved capabilities without bearing the burden of the total development cost.

B. Potential Pathfinder Commercial Opportunities

NASA inventoried ISS capabilities, facilities, and services to identify the areas that may represent commercial opportunities within each of the three major categories: (1) users; (2) operations, and; (3) new capability development. To this was added our past experience with research activities, the experience with each NASA Commercial Space Center (CSC), our discussions with industry, and insight from prior proposals received. We intend to continue use of the CSC's and industry to further validate these opportunities in future updates to this plan.

As the ISS user base develops and new requirements are identified, NASA plans to use commercial providers to meet emerging needs. One area that exemplifies this is the ISS Product Improvement Project, which identifies the requirements for upgrades, as well as determines whether they can be provided by commercial products or services. On July 31, 1998, six public announcements were issued to identify companies interested in participating in ISS Product Improvements.

A primary source for identifying commercial opportunities has been and will continue to be the CSC's, along with their many ties to industry and academia. The CSC's are, by charter, breeding grounds for new commercial ventures and, as such, serve as excellent sources for finding high-potential commercial candidates.

Finally, from time to time, NASA receives unsolicited commercial proposals from companies and individuals offering their products or services to NASA. This avenue of development is expected to continue, and NASA intends to reengineer internal processes for streamlining the dissemination of unsolicited proposals across the Agency.

Seeking new opportunities for commercial development is a continuous process. NASA has completed an initial search, and Figure 2 summarizes the range of potential commercial opportunities identified to date. The next step is for industry to perform a similar process to validate and enhance our results.

Users	*Operations*	*New Capability Development*
Pharmaceuticals	Mission Planning	Augmentation: Core Resources
Biotechnology	Training	Augmentation: New Resources
Materials	Flight Control	Additional Modules and Elements
Electronics/Photonics	Ground Processing	Free Flyers
Communications	Logistics, Repair, and Maintenance	Technology Development
Remote Sensing	Transportation	
Agriculture	Crew and Cargo Delivery/Return	
Imagery	On-Orbit Utilities (e.g., Space-to-Ground Communications,	
Education	Maintenance Engineering,	
Entertainment	Design Support to Customers,	
Advertisement (e.g., PBS Model)	Problem Resolution)	
Space Technology Testbed		
Manufacturing		

Figure 3: Potential Commercial Opportunities

C. Assessment and Selection of Potential Pathfinders

In order to assess and select candidate pathfinder commercial opportunities, NASA developed a set of evaluation factors and rating criteria. The following figures show the rating criteria and method used for identifying pathfinder cases. Figure 4 contains a brief explanation of the rating criteria, followed by a more detailed explanations of the criteria. Figure 5 is a tabulation of the preliminary ratings for each of the initial commercial opportunities. Figure 6 demonstrates the method for comparing and ranking the candidate opportunities by focusing on the high-potential, low-risk, and minimum barrier characteristics.

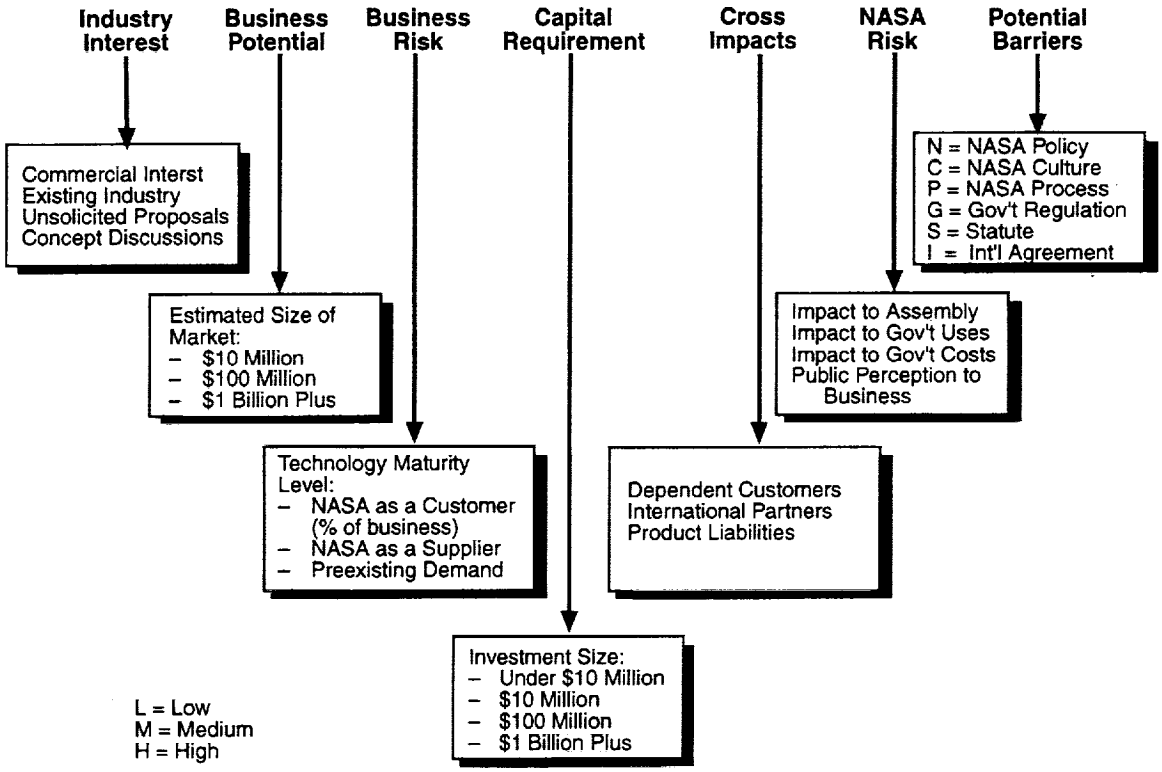


Figure 4: Preliminary Rating Criteria

Industry Interest

The first criterion used to evaluate each opportunity is the perceived commercial interest in developing a business in this area. The rating assigned is based on several factors:

- Is there an existing industry operating in this field?
- Has NASA received many unsolicited proposals?
- Have there been many concept discussions with businesses or individuals seeking to start a new business?

Business Potential

The business potential criterion estimates of the size of the potential market for the product or service. This estimate was based on such considerations as the cost and market size of similar items currently available either in the United States or elsewhere or the item's impact on another industry (for example, protein

crystal growth has the potential to be the foundation for new drug development, thus adding value beyond the initial value of space-grown crystals).

The rating for an estimated market size of $100 million or less annually is Low, $100 million to $1 billion is Medium, and over $1 billion is High.

Business Risk

NASA has performed an initial assessment of the business risk associated with each of the opportunities based on several subjective characteristics. The Agency considered the maturity level of the technologies required for each opportunity and rated them on a technology readiness scale used for many other NASA projects. An evaluation was made of the expected percentage of the business that NASA demand would represent and whether there was preexisting demand for the product or service. Finally, an estimate of the lead time required to bring the product to commercial viability was factored into the overall rating of Low, Medium, or High.

Capital Requirement

The capital requirement, or investment size, estimate was based on NASA experience in developing new projects involving the development of space flight hardware.

The rating for an estimated investment size of $100 million or less annually is Low, $100 million to $1 billion is Medium and over $1 billion is High.

Cross Impacts

This criterion assesses the impact of implementing the commercial opportunity on other activities or groups. Specifically, it asks the following questions:

- Does this activity have any effect, either positive or negative, on the ISS international partners?
- Does this activity have any effect, either positive or negative, on other future customers of the ISS?
- Does this activity have any effect, either positive or negative, on other ISS participants? (For example, does it add power to the overall ISS capability, or does it use so much that it affects other users?)
- Does implementing this business create other business opportunities?

This criterion gets a subjective rating of Low, Medium, or High.

NASA Risk

Each opportunity implemented bears risk for the company starting in the new business area and for NASA. If the new endeavor has the potential to delay or accelerate the ISS assembly schedule, it would receive a negative or positive rating, respectively. Therefore, it is one of the most heavily weighted factors. Other questions entering into the overall rating for this category are:

- How much money must the Government invest in this venture, and how much would be nonrecoverable in case of failure?
- Could this cause the Government to lose other revenue (opportunity cost)?
- What is the expected public perception of this activity?

Potential Barriers

Barriers today can be turned into enablers or motivators tomorrow. Some barriers are easier to change than others. Some can be changed by actions taken within NASA; others require legislation and therefore are more difficult and take longer. By examining the potential barriers to each of the opportunities, NASA identified who controls the barrier and assessed the difficulty to overcome.

Specifically, the opportunities were scrutinized for: NASA policy, NASA culture, NASA processes, Government regulations, U.S. statutes, and international agreements. The types of barriers and the level of difficulty they present (Low, Medium, or High) were then noted in the analysis and entered into the decision of prioritizing opportunities.

		Example Opportunities	Indus. Int.	Bus. Pot.	Bus. Risk	Cap. Rqmt.	Cross Imp.	NASA Risk	Pot. Barr.
		Aeronautics							
		Space Science							
NASA		Earth Science							
		Life/Microgravity Sciences							
		Space Flight Systems							
	1.1	Pharmaceuticals	H	H	M	M	L	L	L/P
	1.2	Biotechnologies	M	M	L	M	L	L	L/P
	1.3	Materials	M	M	L	M	M	L	L/P
	1.4	Electronic/Photonics	M	H	M	M	M	L	L/P
	1.5	Nonelectronic	M	H	M	M	L	L	L/P
Known	1.6	Communications	H	H	L	M	M	M	M/C
Comm.	1.7	Remote Sensing	M	M	L	M	M	L	M/T, G
Uses	1.8	Agriculture	M	M	L	M	L	L	M/T, G
	1.9	Imagery	M	M	L	L	L	L	L-M/C
	1.10	Education	M	M	M	L	L	L	L/C
	1.11	Entertainment	H	H	M	M	M	L	M/N, C
	1.12	Advertising	H	H	L	M	M	M	H/ N, C
	1.13	Space Tech. Testbed	M	M	M	M	M	L	M/T, C
	1.14	Manufacturing	L	M	H	H	M	M	H/P
Un-known	2.0								
	3.1	Mission Planning	L	L	M	L	L	L	L/C
	3.2	Training	M	M	M	M	M	M	M/C
	3.3	Flight Control	M	M	M	M	M	M	M/C
	3.4	Ground Processing	M	M	L	M	M	M	L
	3.5	Logistics/Repair and Maintenance	M	M	M	M	M	M	M/C
Ops. Svcs.	3.6	Transportation	M	M	H	H	M	M	M/C, S, G
	3.7	Crew/Payload Return Vehicles	M	M	M	H	M	M	M/T, C
	3.8	On-Orbit Resources	H	H	M	M	M	M	M/T, C
	3.9	Maintenance Engineering	L	L	L	L	M	M	M/C
	3.10	Design Support to Customers	L	L	M	L	L	M	L/C
	3.11	Problem Resolution	L	L	M	L	M	M	M/C
	4.1	Augmentation: Core Resources	M	H	M	L	L	L	L/T, I
New Cap.	4.2	Augmentation: New Resources	H	H	H	M	M	M	M/T, I
Dev.	4.3	Add. Modules/Elements	M	M	M	M	M	L	M/T
	4.4	Free Flyers	M	M	M	M	M	M	M/C, T

Figure 5: Preliminary Ratings

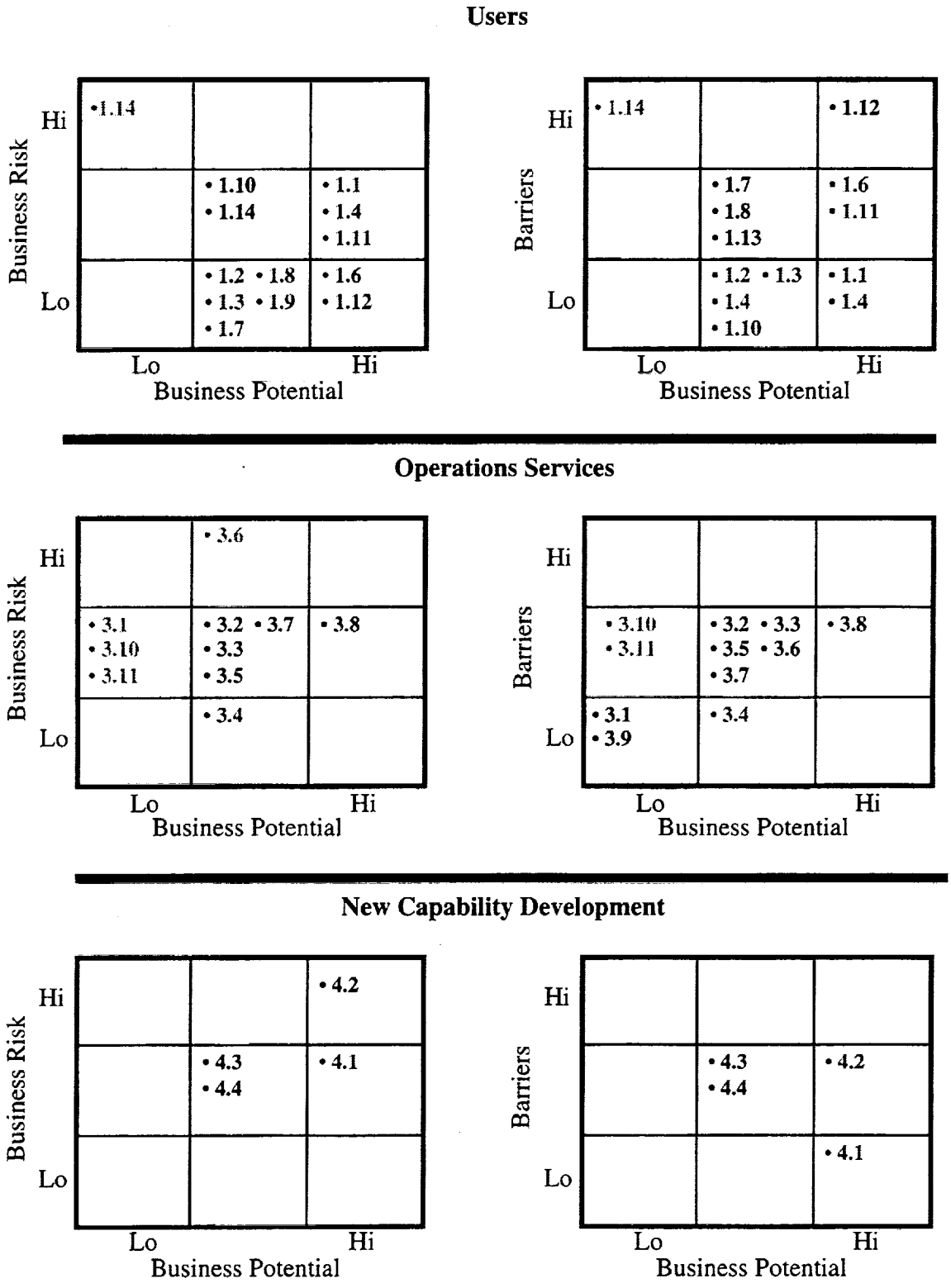


Figure 6: Preliminary Evaluation Methodology

III. Pathfinder International Space Station Commercial Opportunities

Each pathfinder has been selected specifically to demonstrate NASA's ability to satisfy commercial interests, to "push the envelope" in the way NASA currently does business, and to enhance the probability of success. The initial set is listed below.

Uses:
- Consumer Goods in Space
- Brand Name Public Service Sponsorships
- Educational Products
- Payload Accommodations Auction
- New Product Development (Proprietary)
- On-Orbit Research Facility (Proprietary)

Operations:
- Imagery

New Capability Development:
- Communications
- Ground Operations Facility (Proprietary)

NASA is currently evaluating several proprietary proposals, as indicated above, which will be pursued in parallel with the other pathfinder cases. NASA is also using these proprietary cases to improve its handling of incoming unsolicited commercial proposals and proprietary data.

A. Non-Proprietary Pathfinders

Potential Pathfinder: ***Commercial Communications***

Description
Several commercial groups have received licenses for an allocated spectrum in the broadband region (Ku and Ka bands) based on concepts to develop systems that include satellites and would provide worldwide, continuous coverage. Their target markets are both businesses and individuals. The ISS would augment ISS communications capabilities, at about 2002 or beyond, using these new space-based systems on a purely commercial basis.

Long-Term Objectives
Provide greater communications services to support users and ISS operations at acceptable, market-based prices. Utilize commercial service providers to meet ISS needs. Reduce ISS operational costs. Further stimulate in-space commercial communications providers.

Boundaries Pushed
NASA use of commercial service on orbit is novel and will help promote NASA culture, procurement, and technology. The ISS design will likely require designed-in and built-in capabilities to enable the future use of new commercial communications systems.

Strategy
Review new communications systems capabilities. Define specific ISS communications requirements. Identify legal, policy, and procurement steps to be taken. Identify and make technical changes required by the ISS and commercial system (at vendor option) to enable service provision. Procure service on a commercial basis.

Commercial Interests Identified
NASA has initiated discussions with several potential service providers to determine the level of service each plans to make available and the compatibility of their systems with the current ISS design.

Potential Pathfinder: *Brand Names in Public Service Sponsorship (PBS Model)*

Category: ***Users***

Description
Using the Space Shuttle as a precursor to the ISS, NASA should demonstrate the potential for public service sponsorships of key elements, such as flight equipment (for example, cameras) or services (for example, food and beverages), by nonaerospace companies. The model to be followed is aligned with that of the Public Broadcasting System, in which sponsorship is low key and tastefully done.

Long-Term Objectives
Allow opportunities for industry to generate marketing benefits in space while providing meaningful public services. Potentially offset NASA costs. Increase public exposure to the Space Shuttle.

Boundaries Pushed
This should broaden NASA's range of acceptable uses of the Shuttle. Innovative procurement mechanisms may be required, as well as the partial recovery of Space Shuttle operating costs in return for industry opportunities.

Strategy
Identify legal, policy, and procurement steps to be taken, including reassessing NASA limitations on promotional uses of the Shuttle. Evaluate the potential effect on the public's perception of NASA, and determine parameters of acceptable brand name displays and methods. With industry, evaluate the potential scope using market studies. Implement the pathfinder with a near-term flight opportunity.

Potential Pathfinder: *Consumer Goods in Space*

Category: ***Users***

Description
NASA should demonstrate the potential for industry to create added value and generate revenue from the transport of consumer goods to and from space without adversely affecting safety or public perception and at no marginal cost to NASA. Private goods might include memorabilia, honoraria, or educational products that would be transported on the Space Shuttle to the ISS and returned to Earth for sale.

Long-Term Objectives
Expand opportunities for industry to generate revenue in space, creating new markets. Potentially offset NASA costs. Increase public exposure to the Space Shuttle and the ISS.

Boundaries Pushed
This should broaden NASA's range of acceptable uses of the Shuttle and the ISS. Innovative procurement mechanisms may be required. The potential recovery of operating costs in return for opportunities to fly on the Shuttle and the ISS should be explored.

Strategy
Identify legal, policy, and procurement steps to be taken, including reassessing NASA limitations on the transport of goods on the Shuttle or the ISS. Evaluate the potential effect on the public's perception of NASA, and determine parameters of acceptable goods to be transported. With industry, evaluate the potential scope using market studies. Implement the pathfinder with a near-term flight opportunity.

Commercial Interests Identified
Numerous companies have contacted NASA. Most recently, Spacehab has expressed a desire to broaden the range of goods that is carried to orbit in Spacehab modules.

Potential Pathfinder: *Payload Accommodations Auction*

*Category: **Users***

Description
NASA should authorize *auctions* for Space Shuttle and ISS accommodation and resource bundles that correspond to fully functional flight opportunities for one internal pressurized payload site and one external attached payload site. Government constraints on use should be limited to safety and standard payload integration practices.

Long-Term Objectives
Establish private perception of value and magnitude of demand for ISS accommodations in an open market, as free as possible of Government distortion. Employ the results to develop a value-based pricing policy with clear subsidization levels. Using a value-based price can stimulate the creation of new industries, markets, and innovations.

Boundaries Pushed
The auctioning of access to space will likely require advances in policy, procurement, and potentially legislation. In addition, using auctions to provide full ownership to industry will advance NASA's organizational, procedural, and cultural approach to working with industry.

Strategy
Identify legal, policy, and procurement steps required to establish auctions. Fully define resource bundles to be auctioned and specific auction terms, such as duration and minimum bids. Consider auction periods of 2 years to periodically reassess value and demand. Define Government constraints, limited to safety and standard payload integration practices.

Potential Pathfinder: *Imagery*

*Category: **Operations***

Description
By the year 2000, the ISS will return to Earth more imagery in the form of video each day than most local television stations provide. By obtaining commercial sponsorship of selected portions of the video stream, NASA may achieve several goals, including commercialization, wider dissemination of ISS information to the public, and recovery of Government costs.

Long-Term Objectives
Determine the market value of the general downlink imagery aboard the ISS, with the objective of stimulating the creation of new markets. Increase the dissemination and use of such video. Enhance ISS video capture and downlink capabilities, and potentially offset NASA costs.

Boundaries Pushed
The use of commercial sponsorship would be a departure from traditional Federal Government approaches. Policy and procurement boundaries must be advanced. NASA will need to learn how to work with sponsors in a way that meets both NASA and industry goals.

Strategy
Identify policies required to be changed. Define imagery to be reserved for commercial use, and define acceptable uses. Via an open and fair competition, seek, review, and select corporate sponsorship offers. Such sponsorship would include a barter arrangement, in which the commercial firm would receive use of the video (and the right to put its name brand on some of the imagery) in exchange for services or products (such as imagery equipment) provided by the company to the ISS. The privacy rights of the crew, international partners, and scientific and commercial researchers will need to be protected.

Potential Pathfinder: *In-Space Educational Experiments*

*Category: **Users***

Description
NASA will seek to expand the Government-industry partnership to provide an in-space educational experiment program for students and educators. This initiative seeks to help NASA meet its educational goals in a commercial manner, with reduced costs, and supports the development of a commercial space educational service.

Long-Term Objectives
Support NASA's educational programs. Stimulate the development of a commercial educational service program.

Boundaries Pushed
Policy and procurement boundaries will need to be advanced. NASA and industry will need to learn how to work together to meet shared educational goals, particularly in meeting the rigors of educational requirements (such as national standards) in developing an in-flight program.

Strategy
Define industries' educational service goals and NASA educational needs. Identify the policies required to be changed. Establish a procurement mechanism. Define and negotiate cost allocations between NASA and the company, such as costs to design and fly the experiment and to develop the educational elements of the program.

Commercial Interests Identified
A NASA CSC, the Microgravity Automation Technology Center, and the Spacehab corporation have already initiated the *S*T*A*R*S* program for student education through space experiment involvement. This could form the basis for this pathfinder.

B. Proprietary Pathfinders

The following are brief descriptions of commercial cases in which industry has initiated discussions with NASA. Each of these cases is serving as a pathfinder to help NASA create an improved environment for serving commercial needs. The details of these cases cannot be revealed because of their proprietary nature.

Case 1—User Category

A company provides an on-orbit research facility in exchange for the ability to market a share of the capability. NASA receives rights to a share of the capability. The company desires a corporate astronaut as part of package. *Status:* Under negotiation.

Case 2—User Category

A company has developed a systematic method for identifying high-potential commercial opportunities for scientific uses of the ISS. *Status:* Initial opportunities identified, and feasibility studies under way with NASA technical support.

Case 3—New Capability Development Category

A company provides ground facilities and services to NASA and other users. This eliminates the need for NASA to build and maintain similar capabilities. *Status:* Proposal presented, and discussions under way.

Attachment 2

HQ/HEDS/OWI-XXXX
REVISION_Baseline Draft_
October 16, 1998

NASA Headquarters
HEDS Enterprise

Human Exploration and Development of Space (HEDS)

Organizational Work Instruction

Unsolicited Commercial Proposal Clearing House

CHECK THE MASTER LIST at http://_____ /
VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE

DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Canceled)	Document Revision	Effective Date	Description
Baseline Draft		10/16/98	

ISS Unsolicited Commercial Proposal Clearing House

1. SCOPE

1.1 Scope. This HEDS standard procedure (OWI) defines the Commercial Unsolicited Proposal Review process utilized at HEDS to ensure the continuing suitability and effectiveness of ISS Commercial Clearing House in satisfying the HQ quality policy and objectives and the requirements of the *HQC Quality Systems Manual*.

1.2 Purpose. This OWI provides instructions for the conduct of NASA dispositioning of unsolicited commerical proposals for the HEDS Enterprise.

1.3 Applicability. This OWI applies to NASA HQ and all NASA Centers.

2. APPLICABLE DOCUMENTS:

NASA Handbook - Guidance for the Preparation and Submission of Unsolicited Proposals

3. DEFINITIONS

3.1 Unsolicited Proposal -

An unsolicited proposal is a written proposal that is submitted to an agency on the initiative of the submitter for the purpose of obtaining a contract (or other agreement) with the Government and which is not in response to a formal or informal request (other than an agency request constituting a publicized general statement of needs).

To be considered as a valid unsolicited proposal, a submission must:

- Demonstrate an innovative and unique concept or capability.
- Present a specific product or service not otherwise available that would contribute to NASA's mission.
- Be independently originated by the Proposer without Government supervision.
- Contain sufficient technical and cost information to permit a meaningful evaluation, and

- Be signed by an official authorized to contractually commit the organization.

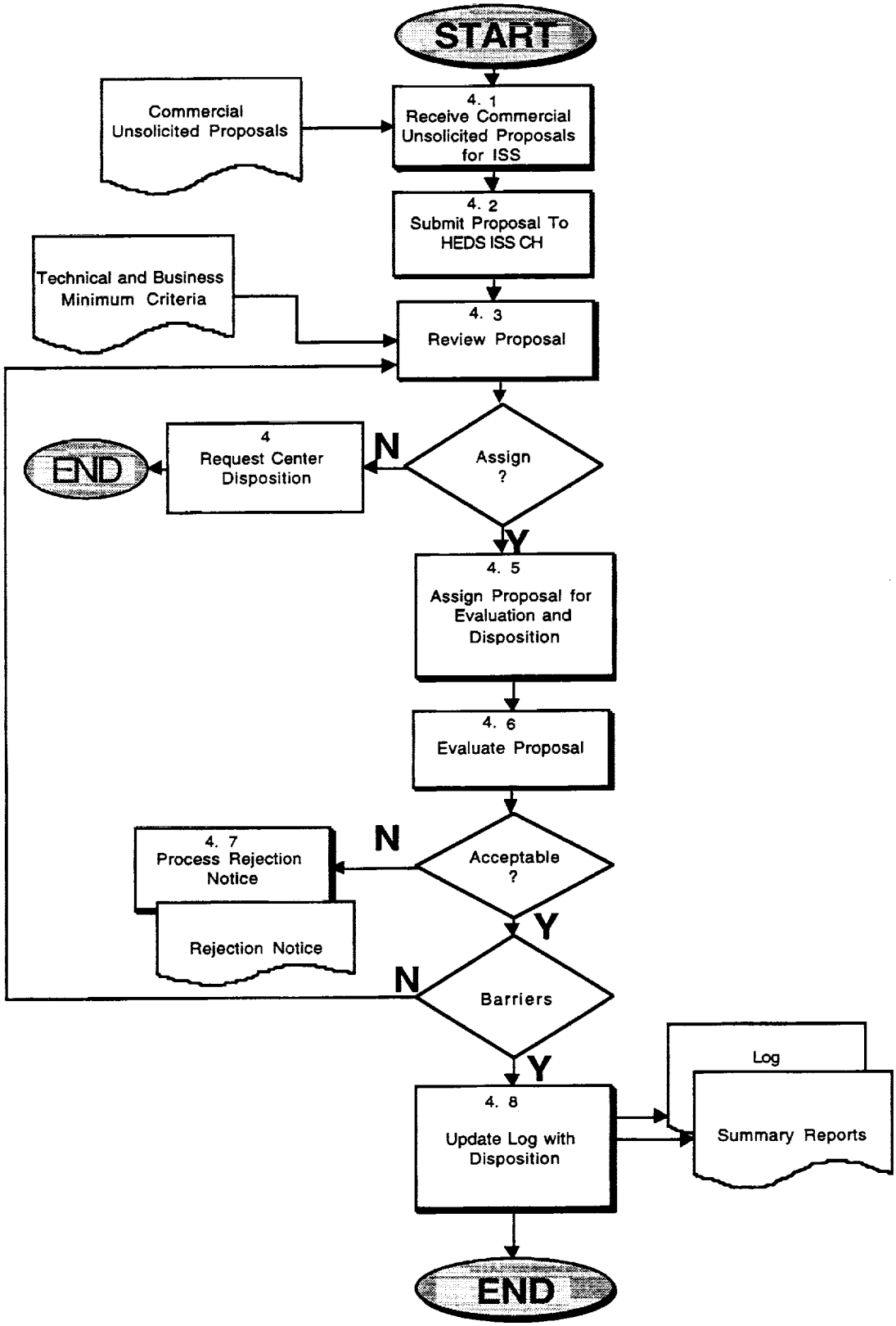
3.2 CH = HEDS Unsolicited Commercial Proposal Clearing House

4. PROCEDURE

Actionee		Action
NASA Entry Points	4.1	Receive Unsolicited Commercial Proposal for ISS
NASA Entry Points	4.2	Submitted to HEDS Unsolicited Commercial Proposal Clearing House
CH	4.3	Review proposal for minimum business and technical criteria and preliminary barrier screening. Resolve any identified barriers. Determine which offices need to review. Decision made whether to assign for more detailed review or reject. If rejected request appropriate Center to disposition (step 4.4). If acceptable for further review assign to appropriate NASA offices (step 4.5) Log actions taken.
CH	4.4	Request Center disposition if rejected in 4.3
CH	4.5	Assign proposal for evaluation and disposition to NASA offices. Designate lead office.
NASA offices	4.6	Evaluate proposals for technical, legal, programmatic, policy and economic acceptability. If acceptable, determine if barriers exist - if yes send back to CH for assistance. If no barriers and acceptable on all other criteria - accept proposal, notify proposer and CH and begin implementation. If not acceptable reject and notify proposer and CH

NASA lead offices	4.7	Process rejection notice
CH	4.8	Update log with disposition and prepare periodic reports.

5. **FLOW CHART**


START
Commercial Unsolicited Proposals
4. 1 Receive Commercial Unsolicited Proposals for ISS
4. 2 Submit Proposal To HEDS ISS CH
Technical and Business Minimum Criteria
4. 3 Review Proposal
Assign ?
N
4 Request Center Disposition
END
Y
4. 5 Assign Proposal for Evaluation and Disposition
4. 6 Evaluate Proposal
Acceptable ?
N
4. 7 Process Rejection Notice
Rejection Notice
Y
Barriers
N
Y
4. 8 Update Log with Disposition
Log
Summary Reports
END

6. APPENDICES, DATA, REPORTS, AND FORMS

None

7. RECORDS, REPORTS AND FROMS

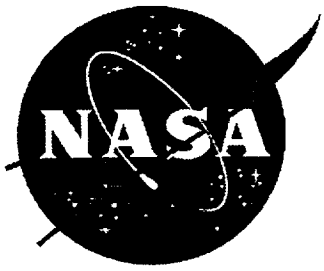
- Records maintained at NASA HQ by CH.

- Log of all actions taken

- Periodic report summarizing proposal activity and dispositions

These records are retained and dispositioned in accordance with NPG 1441.1, Schedule 1/14B.1(a), Permanent - Retire to FRC when 2 years old; transfer to NARA when 20 years old.

Attachment 3



REFERENCE MODEL

A NON-GOVERNMENT ORGANIZATION (NGO) FOR SPACE STATION UTILIZATION MANAGEMENT

Discussion Draft

October 1998

NASA Headquarters Point-of-Contact
Mark Uhran
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"K.E. Tsiolkovsky once wrote: 'The idea, fantasy, or fairy tale invariably comes first. Following this is the stage of scientific investigation. Last comes the crowning achievement of the idea'. From this undoubtedly accurate summarization we need to extract the concept of 'scientific investigation' and examine it more carefully. It is not as easy as it would first appear. Regarding the first step -- the idea, fantasy, or fairy tale – everything is clear. Man has always dreamed of achieving the unattainable (and still does today). Without dreams and the efforts made to attain them progress would be unthinkable. Even if the dream is initially unattainable, this does not mean that it may never be realized. Although harsh reality may intervene repeatedly to prove the impossibility of realizing the dream as yet, reality cannot force people to forget or discard it. Instead the dream is transferred to an original data bank: the fairy tale. There it lives on, continually reminding people of its existence, seeming to await the time when its realization will no longer be impossible.

A more complicated matter is that which Tsiolkovsky called 'scientific investigation.' This stage begins when the general development of scientific knowledge has reached a level of sophistication sufficient to allow someone to appear who is able to envision a way of realizing the dream (very often it is several people who live far apart and who work independently of one another). During this stage the dream begins to move towards reality, but it does not go beyond the discovery that what everyone has heretofore considered an unattainable -- and therefore empty -- dream is in fact possible after all."

from Herman Oberth: The Father of Space Flight
Boris V. Rauschenbach, 1994

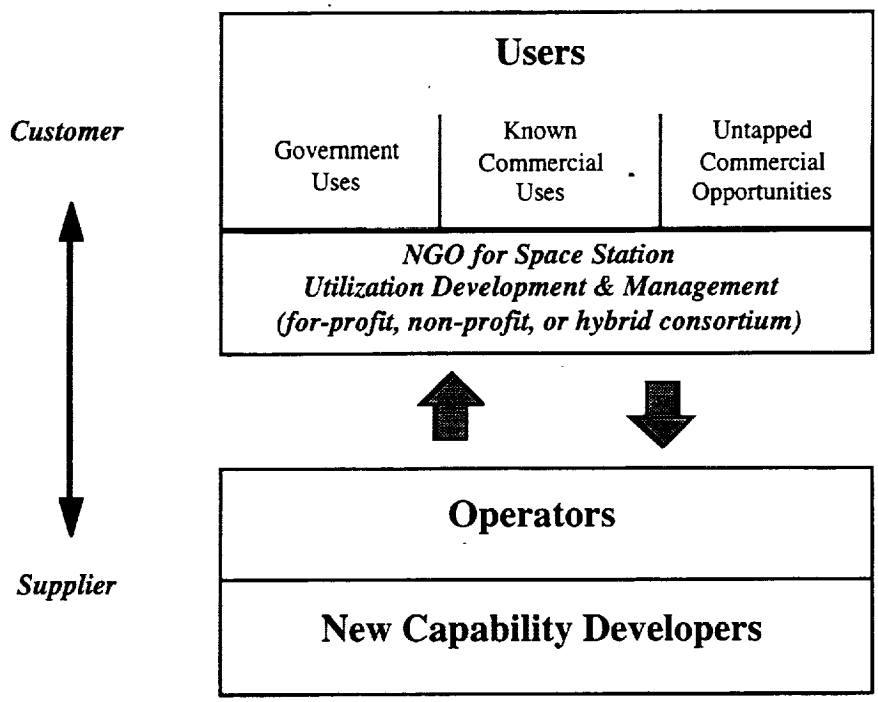
Contents

The purpose of this reference model is to initiate a discussion of a new management approach to R&D in low-earth orbit consistent with the present and future constrained budget challenges. The objective is to create a non-government organization (NGO) for accomplishing an aggressive science, technology and commercial development program while simultaneously limiting government functions to policy and oversight.

The ultimate success of the orbital R&D program depends equally on the efficient operation of the space and ground assets (laboratories, spacecraft, space station...) and on the optimal utilization of the assets by the R&D and business communities. The utilization component must be managed in a manner which ensures productivity of the space station and other future ground and space assets. As depicted below, a NGO would serve as the interface between users and operators, in order to maximize the range of productive uses, as well as minimize the cost and schedule associated with conducting user operations in low-Earth orbit

The framework for a NGO should be based on a management structure that is representative of, and responsive to, a broad base within the utilization community. This management structure must possess a high degree of stability that will permit it to undertake and complete an integrated program over the expected life of the space station and associated assets.

Establishing the Customer - Supplier Relationship



VISION

- A dedicated NGO that will develop the low Earth orbit environment for all users (scientific, technological, and commercial), in order to more efficiently advance scientific knowledge, technological capability, and commerce on Earth as a gateway to 21st Century exploration and development of space.

GOALS

1. Complete an operational concept and establish a NGO in the United States by FY 2000.
2. Employ the NGO to reduce the cost and schedule associated with payload operations in space.
3. Employ the NGO to revolutionize the approach to research, exploration and development of space through increased academic cooperation and industrial collaboration.
4. Offer to expand the initial organization to accommodate international aspects in conjunction with completion of the International Space Station.

PRINCIPAL PURPOSES

1. Engage the science community in a cooperative endeavor to aggressively expand the scientific foundation for human exploration and development of space.
2. Engage the engineering community in a collaborative endeavor to aggressively expand the technological capability of the International Space Station and enable future human exploration and development of space.
3. Engage the space operations community in a revolutionary transition toward cheaper, better and quicker access to space for the conduct of R&D and commercial endeavors.
4. Disperse information on the resulting scientific and technological achievements for the benefit of life on Earth, while stimulating the commercial community to expand the global economy in space products and services.

WORKING PRINCIPLES

(a) Scope of R&D Program Management

- The scope could include all R&D projects which utilize a US share of the International Space Station.
- Collaborating and supporting research using other NASA ground, air, and space assets could be included by written agreement.
- Basic and applied, flight and ground, research in science and technology could be pursued with strategic direction in selected areas such as, but not limited to:
    - biology, chemistry and physics

- medical research and applications
- environmental sciences and life support technologies
- spacecraft system, subsystem and component engineering
- space processing of materials
- biotechnology
- remote sensing
- communications

- The scientific research program could be managed by the NGO and the research projects could be conducted by distributed laboratories, institutes, and research and development facilities in the academic, industrial, and government sectors.

- The technology development program could be managed by the NGO and the development projects could be conducted by distributed laboratories, institutes, and research and development facilities in the academic, industrial, and government sectors.

(b) **Scope of Commercial Program Development**

- Proof-of-concept or full-scale private commercial projects could be administered by the NGO in accordance with national policy.
- The policy could include specific provisions to address totally subsidized, partially subsidized, and non-subsidized entrepreneurial endeavors.
- A value-based pricing schedule could be established during the early operations period, with a transition to cost recovery when commercial enterprises become profitable.
- In the event recovery of public operating costs prohibits profitable operations, or the supply of station accommodations is exhausted, commercial enterprises could relocate to privately owned and operated space platforms.

(c) **Role in Space Exploration**

- The NGO could undertake R&D projects, sponsored by NASA, with applications to the human exploration and development of space enterprise.

(d) **Program and Project Funding**

- Funds could be provided by both public and private sources.
- Public sources could include government agencies which serve as catalysts, such as, but not limited to, NASA.

- Private sources could include philanthropies, industrial organizations, university/industrial consortia, financial institutions, and venture capitalists.
- A privately managed space trust corporation could be created to operate in close association with the NGO, in order to assist in the evaluation and financing of entrepreneurial ventures.

(e) **Program and Project Opportunities**

- Scientific and technological R&D opportunities, which are funded through public monies could be announced on a regular periodic basis and could be open to competition among academic, industrial and government scientists and engineers world-wide.
- Commercial opportunities could be open on a continuous basis for proposals by private organizations.
- Since the magnitude of opportunity will be constrained by available station resources and accommodations, an allocation policy could be established by the NGO Board of Directors.

(f) **Program Integrity and Project Selection**

Scientific Research:

- Projects could be externally peer reviewed to the highest standards and rated, prior to selection by the NGO Science Program Office based on scientific merit.
- The selections would conform to the programmatic objectives and funding levels of the respective sponsors.

Technology Development:

- Projects could be internally reviewed by the NGO Technology Program Office and selected based on engineering feasibility.
- The selections would conform to the programmatic objectives and funding levels of the respective sponsors.

Commercial Ventures:

- Projects could be administered by bonded personnel in the NGO Commercial Program Office.
- Selection criteria could vary with the level of public subsidization.
- Non-subsidized ventures could be selected on the basis of the magnitude of private capital at risk; partially subsidized ventures could be rated by the ratio of private-to-public

funding, and; fully subsidized ventures could be selected at the discretion of the government sponsor.

- The NGO could be required by the Board of Dirctors to administer a portfolio with minimum shares in each of these categories.

(g) **Notification of Project Awards**

- The NGO could issue formal notifications of award, subject to the principles on program integrity and project selection.
- In cases of commercial ventures, with private funding, notifications could be confidential by prior request.

(h) **Distribution of R&D Project Awards**

- Funds could be allocated for award to both NGO-resident (e.g., 10%) and non-resident (e.g., 90%) scientists and engineers on a competitive basis.

Open Item: do the advantages associated with some degree of resident R&D outweigh the disadvantages?

Advantages include:

(1) the ability to attract a high-quality, professionally recognized science and engineering staff;

(2) the ability of the resident NGO staff to work at a peer level with the non-resident R&D community and to serve a "smart buyers";

(3) the increased professional credibility of the NGO; and

(4) the incentive created by broadening the NGO's scope of operations to include resident R&D.

Disadvantages include:

(1) the potential appearance, or actual existence, of a conflict of interest in the resident and non-resident R&D award process.

(i) **R&D Results**

Proprietary Results:

- All R&D results and information could be the property of the funding source and handled without public disclosure, as addressed through binding agreement among the parties.

Non-Proprietary Results:

- All research results could be treated as within the public domain.
- Every research project awarded would be required to conform to the data policy of the funding source.

- All reports could be archived at the NGO and available on-line through international telecommunications networks.

(j) **Resident Staff**

- Resident staff could be representative of the core science and engineering disciplines with visiting senior scientists and engineers in selected specialties.
- All visiting staff could be fully authorized to make decisions and enter into agreements on the behalf of their home institutions.
- Options for a government presence could include a liaison office limited to on-site representatives of the program sponsors, or visiting Senior Scientists and Engineers.

(k) **Project Scientists and Project Engineers**

- Every R&D project could include the designation of a resident NGO staff member as Project Scientist or Project Engineer.
- The role of the NGO Project Scientists and Engineers could be to assist non-resident flight research projects through the steps associated with physical, analytical, and operations integration of flight research projects.

(l) **Research Facilities**

- The NGO could be based in a physical facility (public or private) with either on-site, or geographically dispersed, laboratory assets, or both.
- It could employ state-of-the-art international telecommunications networks for communications with associated organizations from either the public or private sectors.

(m) **Laboratory Assets**

- Existing government assets could be transferred to the NGO for management or made available through negotiated agreement.
- These assets could include both space and ground-based facilities.
- Development of new assets, including flight instruments and facilities, could be performed by the NGO or placed under NGO management.

(n) **Payload Physical, Analytical, & Operations Integration**

- Functions could be performed by the NGO, or a mission support contractor to the NGO.
- Orbital real-time operations replanning could be performed by the space station operator in cooperation with a Mission Director and R&D Working Group assigned by the NGO.

- The NGO could perform all tactical planning for R&D operations on flight and ground systems.

(o) **Organizational Interfaces**

- The NGO could interface with public and private funding sources for space station related policy, oversight and strategic direction;
- with the space station operator (public or private) for payload accommodations and system operations integration;
- with world-wide academic, industrial and government organizations for space station R&D project performance;
- with private organizations for commercial ventures, and;
- with an external advisory committee for independent annual review.

(p) **Instruments of Agreement**

- Agreements between the NGO and associated organizations could be established through a variety of instruments and would be limited only by public law.
- These instruments could be tailored on a case-by-case basis to best protect the interests of the parties.
- The instruments could include, but would not be limited to:

• memoranda of agreement	• memoranda of understanding
• terms of reference	• cooperative R & D agreements
• contracts	• space system development agreements
• grants	• industrial guest investigator agreements
• joint endeavor agreements	• intergovernmental personnel agreements

(q) **Program Planning**

- The NGO could develop projections of available orbital accommodations and resources based on information supplied by the space station operator.
- The NGO could formulate options for accommodating research requirements, maintain a dynamic Mission Model, and produce an annual one-year R&D Program Plan and an annual one-year Commercial Prospectus.
- The Plan and Prospectus could be reviewed and approved by the NGO Board of Directors at an annual meeting.
- The annual Plan and Prospectus could be formulated within the broader context of the funding sponsors' long-term strategic plans and commitments.

(r) **Board of Directors**

- The NGO board could include academic, industrial, and government directors.
- Voting shares on the board could correspond to annual funding commitments of the sponsoring directors.
- The Board could ensure the NGO operates in accordance with its charter and within the policy established by the sponsoring directors.

(s) **Accountability**

- The NGO could produce quarterly reports on cost, schedule and performance status for every active R&D project and an annual report on achievements for every active R&D program.
- All reporting could be subject to proprietary information restrictions.
- The quarterly and annual reports could be the primary products delivered to the funding sponsors (e.g., NASA, or other public and private program sponsors).

(t) **Advisory Committees**

- An independent external advisory committee could perform periodic independent reviews of NGO progress and achievements.
- In the case of the United States, independent advice and guidance could also be provided by the standing boards and committees of the National Research Council.
- The NASA Advisory Council, and its standing committees and subcommittees, could perform periodic reviews at the request of the NASA program sponsoring offices.

(u) **Educational Responsibilities**

- The NGO could include a dedicated Education Office with responsibility for communicating the beneficial attributes of the orbital environment and the progress of the R&D program to public and private audiences at all levels in the academic, government and industrial sectors.
- The costs associated with this function could be funded by the space station owners and operators.

(v) **Criteria for NGO Site Selection**

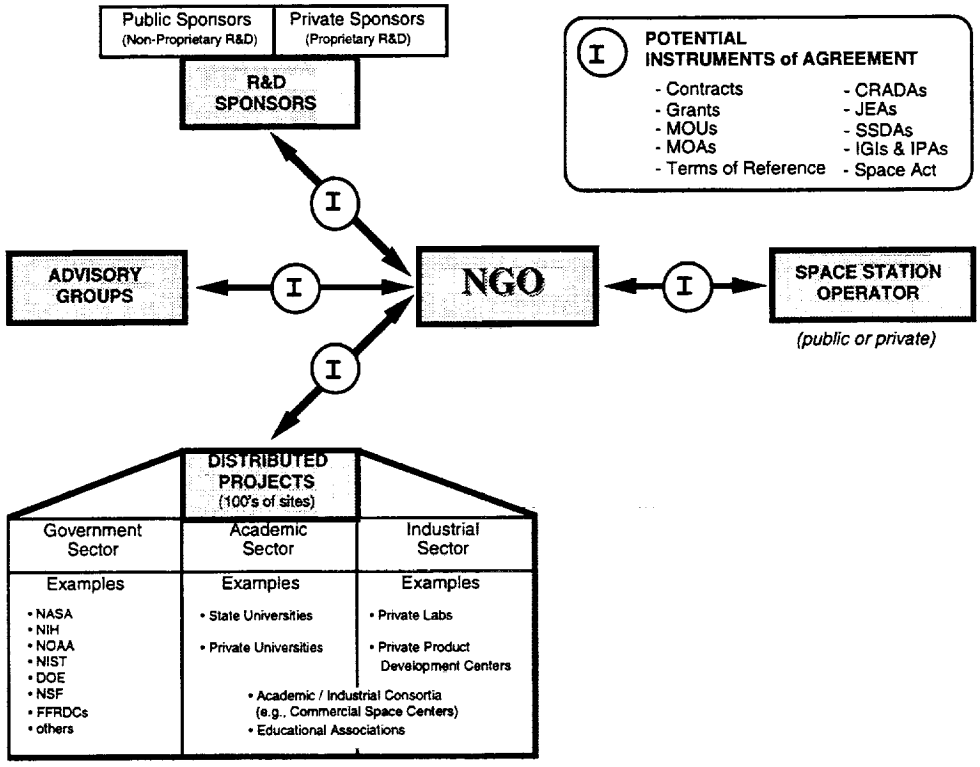
- Criteria could include,
    - availability of existing facilities and skilled personnel;

- geographic attractiveness for personnel relocation;
- easy access for program sponsors and project managers;
- potential for evolution to international operations;
- association with an internationally recognized university;
- support of the local and state governments; and
- proximity to advanced telecommunications resources.

APPENDIX

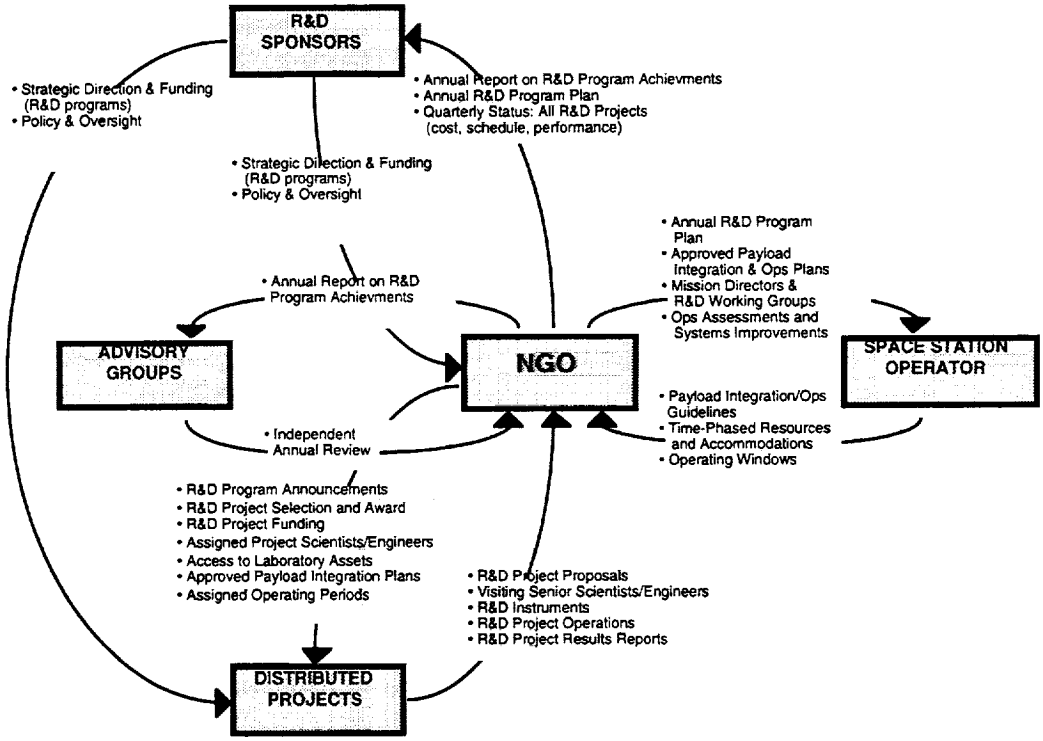
TERMINOLOGY

Working Draft
10/09/98



TRANSACTIONS

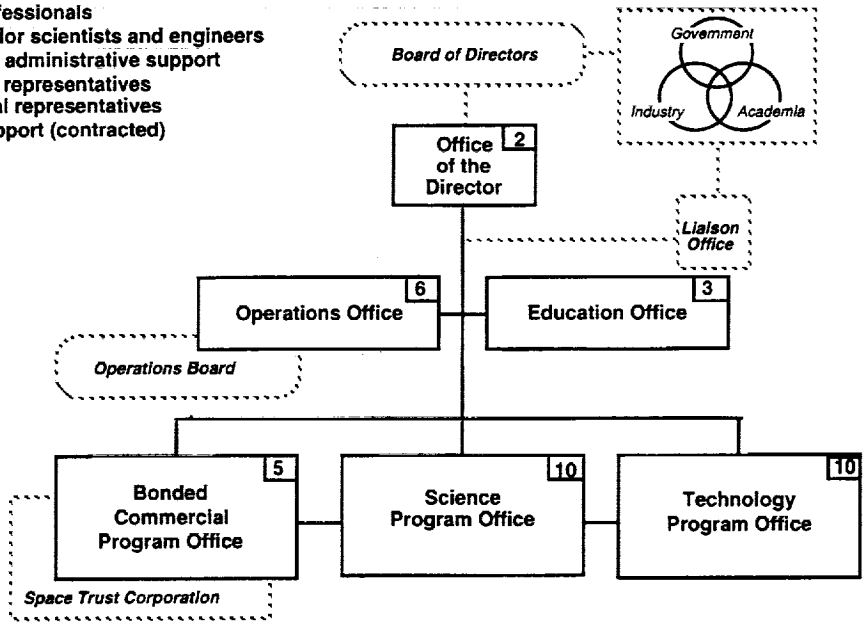
Working Draft
10/01/98



ORGANIZATION

Working Draft
10/09/98

36 **Resident Professionals**
+ visiting senior scientists and engineers
+ clerical and administrative support
+ sponsoring representatives
+ international representatives
+ mission support (contracted)



• Commercial Operations **• Science Operations** **• Technology Operations**

FUNCTIONS

Working Draft
10/09/98

Office of the Director
- selected by the Board of Directors
- utilization program development
- management and administration

Board of Directors
- annually reviews & extends research programs
- communicates policies of the sponsoring organizations
- approves Annual R&D Program Plan and Commercial Prospectus

Liason Office
- staffed by national and international program sponsors
- represents sponsors and provides oversight

Education Office
- develops collateral products for education
- communicates attributes of orbital environment and achievements of the R&D programs

Operations Office
- strategic, tactical, and contingency planning
- manages resource allocations & mission model
- manages mission support contract
- produces annual R&D Program Plan and annual Commercial Prospectus

Operations Board
- selects Project Scientists & Engineers for residency
- approves visiting Senior Scientists & Engineers
- assigns Mission Directors and R&D Working Groups
- approves payload integration plans & flight assignments
- assigns operating periods & accommodation sites

Science Program Office
- scientific research program management
- conducts nominal share of scientific research
- establishes science project queue
- defines requirements for flight instruments
- procures/develops flight instruments
- manages analytical, physical and operations integration
- manages science results archive

Technology Program Office
- technology development program management
- conducts nominal share of technology development
- establishes technology project queue
- defines requirements for flight equipment
- procures/develops flight equipment
- manages analytical, physical and operations integration
- manages technological results archive

Bonded Commercial Program Office:
- implements commercial policy of government sponsors
- liaisons to private sector and Commercial Space Center network
- establishes commercial project queue
- manages analytical, physical and operations integration
- maintains proprietary procedures and protocols

Space Trust Corporation
- manages private capital funds
- selects private ventures for funding with equivalent rigor to private capital markets
- finances qualified private ventures, if necessary

RESPONSIBILITIES

Working Draft
10/09/98

NASA	NGO
Headquarters	
STRATEGIC NASA R&D PROGRAM PLANNING: • Strategic direction and funding of R&D programs. • Policy formulation. • Oversight of NGO.	**STRATEGIC SPACE STATION UTILIZATION PLANNING** • Strategic utilization planning for science, technology and commercial programs/projects. • National & International collaboration and coordination for scientific research and technology development programs. • Integration of station-wide utilization requirements. • Definition and assignment of orbital operating periods to R&D projects. • Mission modeling, resource allocation, and bartering. • Utilization advocacy and education.
Field Centers	
R&D PROJECT MANAGEMENT • specific NASA projects	**SPACE STATION UTILIZATION PROGRAM MANAGEMENT** • station-wide management integration for US programs. • US interface to international partner utilizationprograms for mission integration.
DEVELOPMENT • Manage and conduct design, development, test, and evaluation of advanced spacecraft system projects for NASA Enterprises. • Manage and conduct design, development, test, and evaluation of current space station payload facility class hardware, through to completion and on-orbit test and verification.	**DEVELOPMENT** • Manage development of requirements and specifications for next generation government sponsored payload hardware. • Manage design, development, test and evaluation of future government sponsored payload elements. • Develop recommendations for flight/ground system improvements.
OPERATIONS & MAINTENANCE (potential GO-CO elements) • Manage safe operation and maintenance Space Shuttle and International Space Station. • Manage safe operation and maintenance of government ground-based laboratories, control centers, and facilities.	**OPERATIONS & MAINTENANCE** • Manage payload flight / ground systems operations & maintenance. • Manage payload analytical, physical and operations integration. • Represent US interests in international forums and provide Mission Director(s) and R&D Working Groups. • Develop requirements for payload crew skills and qualifications. • Manage payload data processing, data distribution, and results archiving.
HUMAN RESOURCES (potential GO-CO elements) • Maintain occupational safety and health of flight crews and ground personnel. • Manage & conduct training of flight crews and ground personnel.	

STAKEHOLDER VETTING

Working Draft
10/09/98